



recent developments

Sandia Assists SEGS Operating Companies

The nine Solar Electric Generating Systems (SEGS) power plants located in Southern California, with an existing capacity of 354 megawatts, are the only utility-scale solar thermal power plants currently operating in the world. Built between 1985 and 1991 and incorporating many design features developed by the Department of Energy, the plants represent greater than 90% of the world's grid-connected solar power.

Each plant uses thousands of parabolic-trough solar collectors to concentrate solar energy onto receiver tubes that heat a synthetic oil to more than 700 °F. The hot oil then passes through heat exchangers that produce steam and drive a turbine-generator to make electricity.

In order to optimize the operation and maintenance (O&M) of these systems, Sandia has been providing technical help to the three operating companies—Kramer Junction Company (KJC), Daggett Leasing Corporation (DLC), and UC Operations Services (UCOS)—that manage the nine SEGS plants. Reductions in the O&M costs, which accounts for greater than 25% of SEGS electricity costs, would improve the economics of current plants as well as the future of other solar thermal technologies.

Working with KJC in a 3-yr, 50/50 cost-shared effort, Sandia is investigating techniques for reducing O&M costs. As part of the KJC joint venture, Sandia tested the solar-collecting capacity of an LS-2 parabolic trough, using Sandia's unique rotating platform at the National Solar Thermal Test Facility (NSTTF). The tests helped improve O&M for current SEGS systems and any designs based on these systems. Sandia and KJC also developed a new device to reduce the costs of measuring mirror reflectance and ball joints to replace flexhoses. They are now installing new software to optimize O&M planning.

In another cost-share effort, the Solar Thermal Design Assistance Center (STDAC) is working with Industrial Solar Technology (IST) to develop replacement facets for LS-2 collectors. A prototype facet developed by IST was tested in a Sandia environmental test chamber, with the test program developed cooperatively by IST, KJC, and DLC. The results of the test, which included extreme temperature and humidity cycling, show the replacement facet resisted moisture successfully. Also in support of the LS-2 trough systems, STDAC has started to develop a replacement envelope system that can be installed without removing the receiver tube.

STDAC provided direct technical assistance in investigating and analyzing the adverse effects of two natural occur-

rences on the production and revenues of SEGS plants. All SEGS sites were adversely affected by the June 1991 Mt. Pinatubo volcano eruption, and DLC's SEGS I and II systems were affected by the June 1992 Landers earthquake.

Data analysis by STDAC engineers verified that emissions from the Philippine Mt. Pinatubo eruption did cause a 20% reduction in the direct normal radiation (DNR) at the SEGS California sites. DLC used Sandia's analysis to help obtain a waiver from the Federal Energy Regulatory Commission (FERC) to burn additional gas. The DNR levels recently have returned to near-normal.

The second occurrence, the Landers earthquake, caused significant damage to the SEGS I and II facilities. Sandia performed finite-element analysis of the trough structures to investigate several structural improvements designed to increase earthquake resistance. One of the improvements is being implemented. A Sandia report will detail the results of this project.

Sandia is working with DLC and KJC to develop a technique to detect mirror misalignments by flying over the field of collectors and videotaping the image; the resulting images would identify misalignments. DLC has had positive experience with a similar technique at SEGS I and II.

STDAC has just initiated a new effort with UCOS, the operators for SEGS VIII and IX, to improve the performance of their plants. Meeting with UCOS, Sandia offered some techniques to optimize operation—such as replacing flexhoses with ball joints and processes to prevent oil freezes, bonnet leaks, and wind damage. Use of an updated reflectivity measuring device and the flyover technique were also recommended.



SEGS I and II site near Daggett, CA. Solar One tower is in left background.

Cooperative Activities with New Mexico

The state of New Mexico, planning to reduce energy consumption by 10% by 1995 in state and government buildings, is in the process of refurbishing as many non-operable renewable energy systems as possible, says engineer Brian Johnson of the state's Energy, Minerals, and Natural Resources Department (EMNRD). In order to help New Mexico fulfill its identified goal, STDAC is providing direct technical assistance and training in statewide solar refurbishment projects. Sandia engineers have joined with the EMNRD and the New Mexico Solar Industries Association (NMSEIA) to refurbish non-operational solar systems in four state institutions, including Northern New Mexico Community College, the State Prison in Los Lunas, Eastern New Mexico University, and the New Mexico Institute of Mining and Technology.

Renewables Support for the California Energy Commission

The DOE solar program is providing cost-sharing and technical assistance to support the California Energy Commission (CEC) and the California Department of Corrections (CDC) to install third-party-financed solar systems in prison facilities. In conjunction with cost sharing provided by the National Renewable Energy Laboratory (NREL), Sandia engineers are researching and analyzing the potential use of solar energy in each prison. The resulting data and its analysis, used by the CEC/CDC in developing Requests for Proposals, will also be available to potential bidders.

STDAC Organizes an ASHRAE Seminar

A STDAC-organized seminar on the fundamentals of solar absorption cooling was presented to 80 members of the American Society of Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE) at their winter meeting. Because of restrictions on CFC (chlorofluorocarbon) refrigerants, many ASHRAE members are now considering applying solar absorption cooling in the field. Sponsored as part of DOE's Solar Heat program and chaired by Sandia, the seminar described solar absorption cooling technology and discussed its application and costs. As a result of the seminar, Sandia has been invited to write an article about solar energy application for the *ASHRAE Journal*, which is distributed to engineers world-wide.

Solar Technology Promoted in Caribbean and Mexico

Sandia is participating in several solar thermal technology projects in the Caribbean and Mexico. STDAC is assisting the University of Puerto Rico at Mayaguez in investigating how solar absorption cooling could be applied in Puerto Rico to alleviate peak electric loads, which are caused by air-conditioning demands. Assistance will be provided in developing a field laboratory and test program at the university. This laboratory will attract local industry and utility interest and support for solar absorption technologies.

A memo of agreement with the University of Sonora, Mexico—to develop expertise in the use of the solar oven (manufactured by Burns Milwaukee) and the solar ice-maker (manufactured by Energy Concepts)—is in process. As part of

this effort, Sandia will provide a display on U.S. renewable energy sources for the Mexican National Solar Energy Conference in October. Also, Sandia is leading a new program that will use USAID funds to procure renewable energy systems for installation in remote areas of Mexico. *U.S. manufacturers of small-scale solar thermal products should look for the Commerce Business Daily announcements about the project so that they can prepared to bid.*

U.S. GSA Investigates Solar

The U.S. Government Services Administration has requested the STDAC's technical support in determining the feasibility of maintaining a solar system on top of a federal building in Carbondale, Illinois. With the possible cofunding of a new system by NREL, Sandia is providing engineering support. The current 10-year-old solar system consists of evacuated tubes that supply heat to an absorption chiller for the building's AC and to supply hot water. The system's collector seals are failing, so Sandia material scientists are examining replacement seal materials. STDAC engineers will use this information to compare the life-cycle costs of replacing the seals in the existing system to installing new solar panels, and will assess the cost of removing the solar system entirely and replacing it with a natural gas system.

SOLTECH94 Conference

Serving as a forum for information exchange between the national laboratories, industry, and users of renewable energy technology, the SOLTECH94 conference was held at Ponte Vedra Beach, Florida. At this year's March conference, the solar thermal electric (STE) sessions described: an overview of the DOE's STE program, Solar Two, international opportunities, parabolic-trough solar thermal power plants, reflective films, and the dish/Stirling and utility-scale joint ventures. Also, KJC introduced a business plan to reestablish a trough power plant capability through a U.S.-led consortium. Sandia engineers also chaired and presented a talk in one of the Solar Process heat sessions.

Technical Briefs

To develop a commercial-scale 25-kW solar thermal system for the 21st century, Cummins Power Generation, Inc. (CPG) and Science Applications International Corporation join Sandia to participate in the cost-shared Utility-Scale Joint Venture Program (USJVP) . . . The Dish/Stirling Joint Venture Program (DSJVP), a program that seeks to put CPG 7.5-kW dish/Stirling systems in remote power markets, is in the process of testing and manufacturing systems to determine a stable design . . . The Renewable Energy Office added ground-sourced heat pumps (geothermal) and direct combustion biomass to the renewable energy options that Sandia's expertise supports . . . The conversion of the water-steam Solar One system to Solar Two, a state-of-the-art molten-salt central receiver power plant, is in process. Solar Two is expected on be on-line in late 1995.

The Solar Thermal Design Assistance Center

The Solar Thermal Design Assistance Center is a national resource that encourages the use of solar thermal systems by cooperating with industry, assisting and educating users, and helping to select, design, characterize, and demonstrate promising solar thermal systems.

Inquiries are welcome, and additional information about any of the above topics is available. Please contact

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